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(54) Liquid heater

(57) An electrical throughflow heater for a dishwashing machine or laundry washing machine comprises a tubular heater element (9) provided in a housing (1), closable by a lid (5), with inlet stub pipe (2) and outlet stub pipe (3). Arranged between the lid and the housing is seal (4) with sealing portions (11, 12) between the lid and the housing and also between the lid and the heater element. The seal (4) also includes a diaphragm (13), which is associated with a switch (16), which is mounted on the lid and which is held in a position closing the heater current circuit by the diaphragm loaded by the pressure of liquid flowing through the heater. A safety device against overheating is thereby provided.

FIG. 1

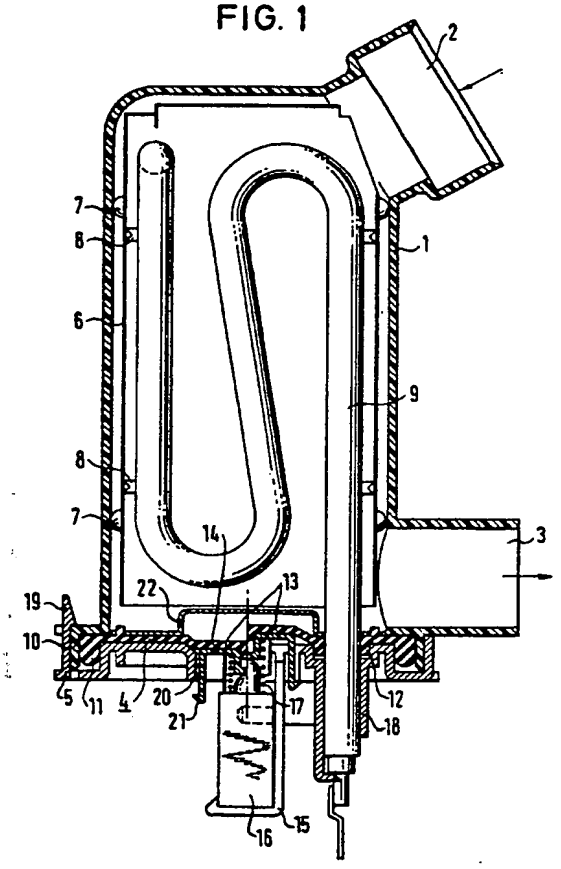

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FIG. 1

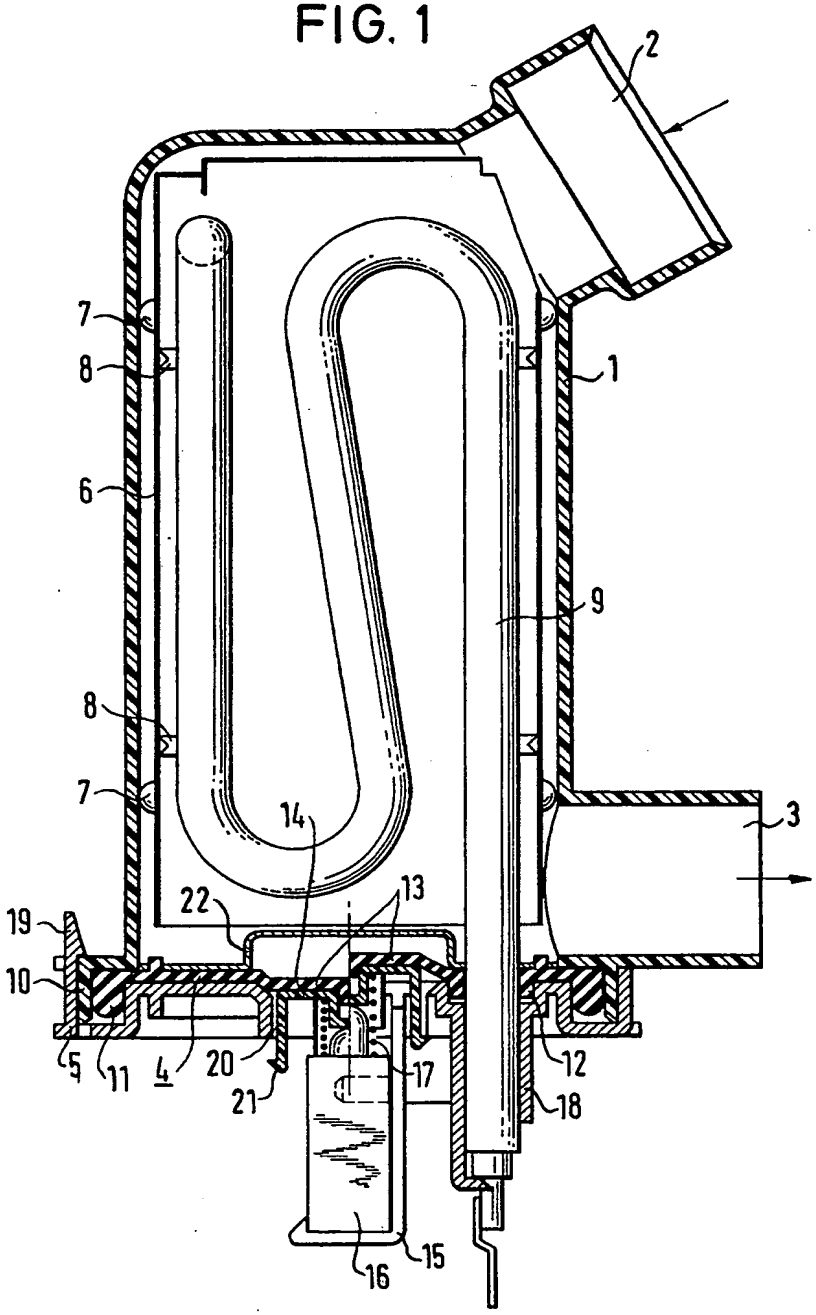
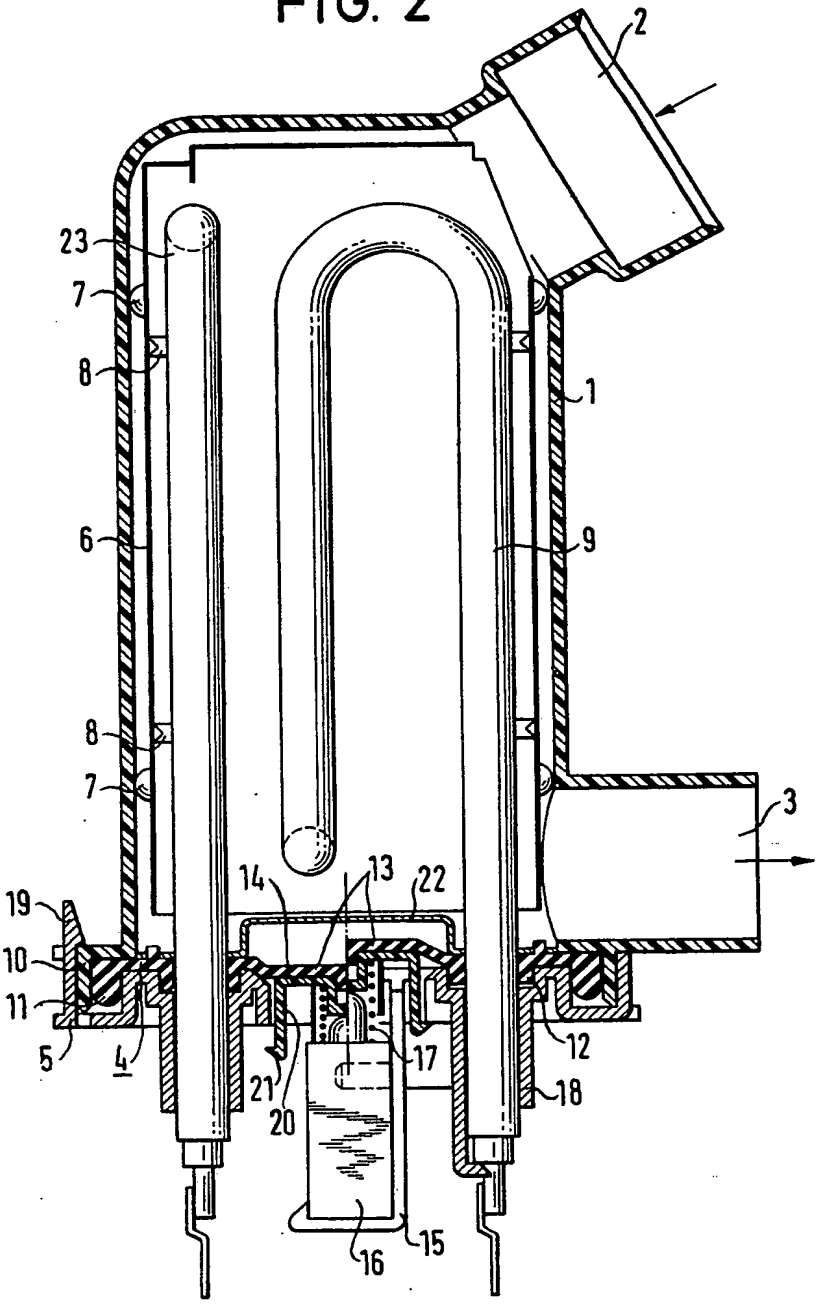


FIG. 2



SPECIFICATION

Liquid heater

The present invention relates to a liquid heater especially for washing or rinsing liquid in a dishwashing machine or laundry washing machine.

In EP 0 044 040 A2 there is disclosed a throughflow heater for washing liquid and rinsing liquid in a dishwashing machine or laundry washing machine, in which at least one electrical tubular heater element is arranged in the path of the liquid flow. The heater housing, which is tubular or parallelepipedonal, can be connected by a stub pipe thereof to a duct system for rinsing liquid between a water inlet or a circulating pump and the rinsing container inlet or a spray device of the machine. In order to limit the temperature transition between the heater and its surroundings, the heater can include a protective sleeve with temperature-resistant thermal insulation. The heater element of the known heater possesses a high heating power referred to its surface. This means that a sudden strong increase in temperature of the heater element within the throughflow heater occurs in the absence of water or water flow so that a temperature limiter then switches off the heating. If this safety device itself fails, the result is burning-out of the electrical heating element within the heater housing or the protective sleeve. The heater housing is sealed or closed off by lids welded on at both end faces.

There remains a need for a simply constructed throughflow heater which can be produced easily and which includes a safety device against overheating.

According to the present invention there is provided a liquid heater comprising a housing having an opening at one end and provided with an inlet and an outlet to permit flow of liquid through the housing, a lid closing the opening, an electric heating element arranged in the housing and extending through the lid, a sealing member arranged between the lid and the housing and having sealing portions sealingly engaging the lid, the housing and the heating element and a further portion which defines a diaphragm deflectable by the pressure of liquid flowing through the housing and electrical switching means arranged on the lid to be actuable by such deflection of the diaphragm.

In a heater embodying the invention, with the lid removed from the housing, an easily accessible assembly opening may be available and the heating element is insertable, by a connecting stub thereof into the lid so as to be mounted together with the lid to the housing. The safety device with diaphragm, and the switching means in a heater current circuit, permit switching-on of the heating element, or elements, of the heater only when there is a flow of liquid through the housing and when thereby a certain minimum pressure, which suffices by way of the diaphragm and the switching means to close the heater current circuit, has built up in the housing. Thereby it is ensured that, for example, the electrical heating of the heater can be switched on through a program control device of the machine only when liquid pressure is present. The switching point of the switching means, which can be constructed as a make-contact of a microswitch.can be chosen to be more or less strong through a spring. If the liquid pressure in the heater falls off during the operation of the machine, for example through film formation or failure of the circulating pump, then the microswitch can switch back into the open setting and thereby automatically, promptly and securely switch off the heating.

Preferably, a pressure plate is movably guided in the lid and is displaceable by the diaphragm against a resilient bias for actuation of the switching means, for example a microswitch. The housing with an inflow stub pipe and an outflow stub pipe, may comprise an integrally moulded plastics material part and be lined at a spacing from the inner housing wall surface by a protective sheet metal sleeve, aluminium foil or the like.

A touch safety device or shield may be associated with the diaphragm of the sealing member on the inside facing the heating element.

For preferance, the lid comprises a guide for the heating element, a detent hook mounting for the microswitch and resilient hooks at the lid rim for the fastening of the lid against a housing collar.

Expediently, when the housing is free of liquid flow or subjected to less than a minimum pressure and the diaphragm is disposed in a rest position, the microswitch assumes its open position interrupting the heater current circuit and the spring holds the pressure plate in a pushed-back end setting against the lid, wherein abutments at lateral guides of the pressure plate limit this end setting relative to the lid.

Preferably, substantially punctiform or line-shaped spacer members are provided between the housing and the protective sleeve and preferably also between the sleeve and the element.

Expediently, the microswitch is arranged in a heater current circuit in series with the heating element, or elements, and a fusible safety device, which can be mounted at the housing or the lid, is additionally provided in the circuit.

In addition, a temperature-responsive device, such as a temperature sensor, temperature-dependent switch, bimetallic switch or the like, can be associated with the circuit and provided in or at the housing or at the lid.

Embodiments of the present invention will

now be more particularly described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a partially sectioned side elevation of a first throughflow heater embodying the invention; and

Fig. 2 is a partially sectioned side elevation of a second throughflow heater embodying the invention.

Referring now to the drawings, there is shown in Fig. 1 a through-flow heater comprising a tubular or parallelepipedonal housing 1, which in an advantageous construction consistsof a single-part moulded plastics material part with an inflow stub pipe 2 and an outflow stub pipe 3. The housing is open at one end face for the insertion of components of the heater. The housing opening is closed with the interposition of a seal 4 by a lid 5. The housing 1 is lined inside by a protective metal sleeve, in particular of fine steel, aluminium foil or the like for protection against overheating of the housing wall and for thermal insulation of the heater. The sleeve 6 is provided with spacer members 7 and 8, which are so constructed that the protective metal plate can lie against the housing, and a tubular heater element 9 against the protective metal plate, only punctiformly or linearly with the heat transfer from the heater to the housing as small as possible.

The seal 4 in the region of its outer encircling rim forms a sealing ring 11 which is insertable between a housing collar 10 and the lid 5. Apart from this sealing portion 11, the seal 4 includes a second sealing portion 12 for sealing of the connecting stub, extending through the lid 5, of the heater element 9. In the middle portion, the seal is constructed as a diaphragm 13, which is supported at the outer side by a pressure plate 14 movably guided in the lid 5. A microswitch 16 is fastened in a detent hook mounting 15 on the outside of the lid 5 remote from the diaphragm and a compression spring 17 is inserted between the microswitch and the plate 14. The lid 5 includes a guide 18 for the terminal end of the tubular heater element 9 and is detentable against the housing collar 10 by resilient hooks 19 at the lid rim. The lid can, if required, be additionally fastened at the housing tightly and firmly by a tension band. Abutments 21, which in the end setting of the plate 14 can bear against the lid, are provided at a lateral guide 20 of the plate 14 as limitation of the movement of spring-loaded plate. Towards the interior space of the housing of the heater, the diaphragm 13 is shielded relative to the heater element by a cover 22 as touch safety device.

For the further protection of the throughflow heater against overheating, a fusible safety device and/or a temperature sensor with thermostat switch or th like can be provided in or at the housing 1 or at th lid 5.

The heater is connectible, for example, by its inlet stub pipe 2 with the interposition of an O-ring, to the pressure stub pipe of the circulating pump of a dishwashing machine and by its outlet stub pipe 3 to the liquid duct for the spray devices of the machine, and thus is disposed outside the rinsing container.

The required quantity of water flows towards the rinsing container of the dishwashing machine before a program portion for the heating-up of the rinsing liquid or washing liquid. Through switching-on of the circulating pump, a pressure, which deflects the diaphragm 13 and displaces the pressure plate 14 towards the microswitch 16 against the spring force acting on the plate, is built up by way of the conveyed flow in the heater. The microswitch is constructed as a make-contact and arranged in series with the heater element in the heater current circuit so that the electrical heating can be switched on by way of the program control device when the required liquid pressure is present. The switching point of the microswitch can be increased more or less strongly through the selection of the rate of the spring 17 in order to preset a minimum pressure. In the case of pressure drop, for example through film formation, idling of the cirulating pump, switching-off of the circulating pump, lack of water and so forth, the microswitch switches back into the open setting and thereby switches off the electrical heater element.

When the program has run down and for program steps without water, the heating is switched off in double pole, firstly by way of the program control device and secondly by way of the microswitch and the risk of an earth short-circuit is thus excluded. In the case of undisturbed program run-down, the microswitch is not switched under load and thereby has a long working life.

Fig. 2 shows an embodiment with two tubular heater elements 9 and 23 and intended for, for example, a polyphase construction of the machine.

CLAIMS

1. A liquid heater comprising a housing having an opening at one end and provided with an inlet and an outlet to permit flow of liquid through the housing, a lid closing the opening, an electric heating element arranged in the housing and extending throughthe lid, a sealing member arranged between the lid and the housing and having sealing portions sealingly engaging the lid, the housing and the heating element and a further portion which defines a diaphragm deflectable by th pressur of liquid flowing through the housing and electrical switching means arranged on the lid to be actuable by such deflection of the diaphragm.

2. A heater as claimed in claim 1, wherein the housing is substantially tubular.

3. A heater as claimed in claim 1, wherein

the housing is substantially parallelepipedonal.

4. A heater as claimed in any one of the preceding claims, the switching means comprising a microswitch.

5. A heater as claimed in any one of the preceding claims, wherein said further portion of the diaphragm is disposed centrally of the diaphragm.

6. A heater as claimed in any one of the preceding claims, comprising a pressure plate guided in the lid to be displaceable against a resilient bias by the diaphragm to actuate the switching means.

7. A heater as claimed in any one of the preceding claims, comprising a temperature-resistant protective sleeve arranged in the housing and around the heating element.

8. A heater as claimed in claim 7, wherein the housing is made of plastics material and the sleeve is arranged in the housing adjacent to but at a spacing from the internal wall surface of the housing.

9. A heater as claimed in either claim 7 or claim 8, wherein the sleeve is made of steel, aluminium or other metallic material.

10. A heater as claimed in any one of the preceding claims, comprising a shield element arranged in the housing and extending over the diaphragm.

11. A heater as claimed in any one of the preceding claims, wherein the lid comprises a guide passage for the heating element, a detent hook for detent mounting of the switching means and resilient connecting hooks arranged at the circumference of the lid and connecting the lid to the housing.

12. A heater as claimed in claim 6, wherein the pressure plate is provided with abutments engageable with the lid in a rest setting of the plate and diaphragm in which the pressure acting on the diaphragm internally of the housing is insufficient to displace the diaphragm and plate against the resilient bias, the switching means being disposed in an unactuated state in the rest setting of the plate and diaphragm.

13. A heater as claimed in either claim 6 or claim 12, the resilient bias being provided by spring means.

14. A heater as claimed in any one of claims 7 to 9, comprising spacer members provided between the sleeve and the housing and disposed in substantially punctiform or linear contact with the sleeve or the housing.

15. A heater as claimed in any one of claims 7 to 9 and 14, comprising spacer members provided between the sleeve and the heating element and disposed in substantially punctiform or linear contact with the sleeve or the lement.

16. A heater as claimed in any one of the preceding claims, comprising circuit means for the supply of operating current to the heating element, the switching means and a fusible devic being arranged in the circuit means in series with the heating element.

17. A heater as claimed in claim 16, wherein the fusible device is arranged in the housing or the lid.

18. A heater as claimed in claim 1, comprising temperature-responsive means arranged in or on the housing or on the lid and associated with circuit means for the supply of operating current to the heating element.

19. A heater as claimed in claim 18, the temperature responsive means comprising one of a temperature sensor, a temperature-dependent switch and a bimetallic switch.

20. A liquid heater substantially as hereinbefore described with reference to the accompanying drawings.

21. A dishwashing or laundry washing machine comprising a heater as claimed in any one of the preceding claims for heating washing or rinsing liquid in the machine.

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